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SPATIAL OCCURRENCE AND DISTRIBUTION OF ASCIDIAN FAUNA ALONG THE COASTAL WATERS OF SOUTHERN INDIA

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ABSTRACT

Ascidians (Tunicata) are gaining paramount importance in raising marine biodiversity. Considering ongoing changes in marine ecosystem, seasonality in the recruitment of ascidians and their invasive nature, the arrival of ascidians is increasing in India. In this context, a field study was carried out in selected transects of South Indian coastline during 2012–2014 to understand occurrence and distribution of ascidians. The study revealed the occurrence of 36 species of ascidians belonging to 7 families and 17 genera inclusive of 2 new records. The highest number of species was found in the family Didemnidaefollowed by Styelidae. The most abundant colonial species were *Eudistomapyriforme, E. microlarvum, Botrylloidesmagnicoecum, B. schlosseriPhallusianigra, Aplidiummultiplicatum, Didemnum psammathodes, Lissoclinum fragile, L. bistratum*and*Eudistomasluiteri*. *Botrylloidesmagnicoecum, B.leachie* and *B. chevelence* were present exclusively in Colachel. Among the 37species, *D. psammathodes* and *L. fragile* were found majority of the stations studied. *E. microlarvum* and *E. sluiteri* were reported for the first time at Tiruchendur water. Four species of the sub-family Botryllinae of Styelidae and one species of Didemnids were fouling the entire hull of boat at Colachel station. An increasing trend in the occurrence of ascidians in southern Indian waters reinforces the need for continued and periodic monitoring of their population expansion and also for sustainable utilization towards human welfare.

KEYWORDS: Ascidians, Indian Coastal Waters, Distribution, Occurrence

INTRODUCTION

The Class Ascidiacea of sub-phylum Tunicata constitutes a unique group of animal that serves as an essential source for a variety of studies in fields ranging from development and evolution to immunology and biotechnology. There are about 3000 species of ascidians reported worldwide so far. Ascidians have been proven for their potential to produce new lead molecules with significant pharmacological activities (Davidson, 1993; Rinehart, 2000; Haefner, 2003 and Jain et al, 2008). They are also used as food in the form of various preparations in many parts of the world including India (Nanriet al, 1992 and Tamilselviet al, 2010). Few solitary ascidians serve as indicators to assess the quality of water (Abdul Jaffar Ali, 2004; Tamilselvi, 2008 and Abdul Jaffar Ali et al, 2011). On other hand non-indigenous ascidians have significant effects on the natural fauna (Cohen et al, 2005) leading to significant economic problem since ascidians form an important group of fouling communities (Carver et al, 2003).

Since ascidians can thrive on both stationary and mobile artificial structures (Shenkar, 2008), they have a high potential for introduction into new regimes. In recent decades, marine habitats have come under increasing stress from land based sources of pollution, shipping, physical impact of maritime activities, dredging, coral mining etc., which in turn cause upset the number and biomass of fauna and flora.

Ascidians are one among the key ecological groups as the environmental variables influencing their recruitment, dispersal, survival and reproduction.

Although in the past two decades enormous progress on tunicates has been achieved throughout the world, this group of animal has barely been studied in India. This could be substantiated with a popular belief among the biologists that the ascidians are rare and extremely poor with respect to number and abundance of species. In spite of being conspicuous and macroscopic, very little attention has been given to this group in India. The increasing evidence of multifarious potential of ascidians highlights the need for additional research into the diversity and distribution of ascidians for sustainable utilization and conservation of this group of animal.

Nevertheless, considering ongoing changes in marine ecosystem, the arrival and proliferation of non-indigenous ascidians is expected in future. Early knowledge on the ascidian fauna needs updating to have a better understanding of the present status of ascidian diversity. It is imperative to search a new collection of ascidians from this region in order to provide an up-to-date species description and their distribution. In this sense, a field study was established oncertain transects along the southern coast of India to understand occurrence and distribution of ascidians on spatial scales.

MATERIALS AND METHODS

For the present study, a total of 13 stations of various coastal areas along the Southern Indian Peninsula (Fig 1) were sampled during the period of two years from August 2010 to July 2012 (Table 1).

Various coastal areas were visited during low tide periods along the southern Indian peninsula. Ascidian samples were collected by adopting various collecting methods such as hand picking, peeling off, scraping, dislodging etc. Both natural and artificial substrates available at these stations were surveyed in shallow waters (<3 m) in different habitats by walking access and snorkeling. SCUBA divers were engaged to sample at marinas to remove ascidians from the undersides of floating docks and barges. The collected specimens were narcotized using a pinch of menthol crystal and preserved in 8% formalin with seawater.

The specimens were sorted and identified to species level by following taxonomic keys of Tokioka, 1967; Monniot&Monniot, 1996 andKott, 2001.

RESULTS

In the present survey, a total of 36 species under 17 genera and 7 families (Polycitoridae,Polyclinidae, Didemnidae, Perophoridae,Ascidiidae, Styelidae andPyuridae) inclusive of 2 new records were recorded from 13 stations covering variety of habitats along the southern Indian coastal waters (Table 2 and Figure 1). Of these, 4 species were represented by simple and the rest 32 by colonial ascidians. The present study revealed the entry of two species such as*Eudistomasluiteri*, and *Diplosomasimileguva*(Figure 3) to Indian waters for the first time and thus adding two more species to the Indian ascidian.

It is noteworthy to state that maximum number of species (10) was recorded at Vizhinjam Bay, Mandapam and Tuticoirn coast followed by Colachel (7) and Tiruchendur (6). Certain species such as *Eudistoma pyriforme* and *E. microlarvum*at Tiruchendur, *Botrylloides magnicoecum* and *B. schlosseri*at Cholachel and *Phallusianigra*and*Aplidiummultiplicatum* at Vizhinjam Bay and *Didemnum psammathodes*, *Lissoclinum fragile*, *L. bistratum* and *Eudistomasluiteri* at Tuticoirn water were abundantly found and dominant in these specific study areas.

More number of species were recorded from the genus *Eudistoma* (6) followed by Polyclinum (5) (Figure 2).

DISCUSSIONS

A total of 36 species belonging 17 genera and 7 families recorded from the present study showed that there was an increasing trend in the distribution of ascidians in Indian waters. This increase might be due to the connectivity of most of the fishing harbour with the ports from the peninsular India. This ship movement and also from the ballast water that could be an easy transport of ascidians in the form of larva in to Indian waters. The large numbers of boats with fouled hulls, especially small pleasure craft that move from one harbor to another undoubtedly provide new breeding stock to recolonize denuded surfaces and also enhance gene flow between harbors. This increasing trend is further substantiated with the entry of two new reports to Indian water.

In the present study, maximum numbers of ascidians were recorded from the east coast of India. It could be correlated with the plenty of suitable substratum available here including naturalas well as man - made substrata which might have assisted in the settlement of the ascidians. Kott (2002), Abdul Jaffar Ali (2004) and Tamilselvi et al, (2011) reported that the harbour installations could have facilitated the settlement and distribution of ascidians species. Of all the stations along the east coast, Thoothukudi harbour area harboured more number of ascidians. This higher ascidians recorded in this station could be correlated with the availability of diverse habitats in the form of break of waters, barges, harbour installations, boulders, pebbles, pearl oyster cages and periodical ship movements from other countries. Furthermore, these stations are located in Gulf of Mannar, a hot spot area for rich biodiversity and also a National marine park area. This Gulf of Mannar sea water is always calm in nature except in few seasons, tend to promote rich faunal and floral diversity. The absence of ascidians was also recorded from Pozhikarai and Kadiyapattanam which could be due to the presence of purely sandy substratum and devoid of any natural or artificial structures. The present observation is also confirmed with the reports of Young (1989) who reported that habitat stability is an important criterion for survivorship of an organism and sand movements adversely affects the settlement of its larvae.

When compared to east coast the west coast is always rough in nature and the number of substrata available for the settlement of ascidians is also very few. This nature probably might have prevented the settlement of wide variety of ascidians in almost all the stations of the west coasts studied except at Vizhinjam Bay. This Bay at the west coast is a harbour area containing many habitats including break waters, which is supposed to be calm in nature. So the Vizhinjam harbour with plenty of available substrata could have allowed the settlement of many ascidians.

Occurrence of more number of colonial ascidians and their distribution in majority of the stations could be due to the colonization of zooids nearby the parent colony by asexual reproduction and ability to retain its larvae in brood pouch (Yund andStires, 2002 andTamilselvi et al, 2011). Few colonial ascidians remain close to the parents through frequent fission (Bak et al, 1981; Ryland et al, 1984 and Stocker 1991). Osman and Whitlatch (1998) reported that colonial ascidians are good special competitors inhibiting the recruitment and settlement of other organisms. This could also be supportedby Tsurumi and Reiswig (1997) who observed the reattachment offragmented colony to the available substratum.

The present survey revealed that ascidians spread most of the coastal areas along the southern coastof India. Availability of diverse substrates, heavy traffic of intercoastal movements of ships and fishing vessels and also certain life history traits determine the distribution and abundance of ascidians. This updated and current status of occurrence and distribution of ascidians can better be utilized sustainably for the future studies.

CONCLUSIONS

The present survey revealed that that ascidians spread most of the coastal areas along the southern coastline of India. Availability of diverse substrates, heavy traffic of inter-coastal movements of ships and fishing vessels and also certain life history traits determine the distribution and abundance of ascidians. This updated and current status of ascidian distribution can better be utilized sustainably for pharmacological products.

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APPENDICES

Table 1: Study Areas with Available Substrates

Stations	Latitude and Longitude	Natural Substratum	Artificial Substrata
Vizhinjam Bay	8˚22'36"N-76˚59'16" E	Embedded rocks, Mussel Bed, Molluscan shells	Cement blocks, calcarious stones, pearl oyster cages, hull of boats and barges
Colechel	8°9'46"N -77°15'44"E	Embedded rocks	Port installations, calcarious stones, pillars installed for bridge, hull of boats.
Kadiapattanam	8°7'47"N-77°18'18"E	Submerged rocks	Nil
Muttom	8°7'14"N-77°18'44"E	Large boulders and small embedded rocks	hull of boats

Pozhikarai		Nil	Large boulders, and stones
Kanyakumari	8°5'47"N-77°32'17"E	Small and large embedded rocks,	Cement blocks and pillar of Jetty
Oovari	8°17'14"N-77°53'49"E	Small embedded rocks	Nil
Kulashekarapattanam	8°24'1"N 78°3'24"E	Sand	Nil
Kayalpattanam	8°34'15"N 78°7'15"E	Sand	Nil
Thiruchendur	8°29'10"N-78°7'3"E	Large boulders, and stones	Nil
Thootukudi	8°45'7"N-78°12'37"E	Small embedded rocks, branches and roots of tree and algae and sea weeds	Hard rocks, hulls of ships, floating objects like ropes, raft, barrels, nets and harbour installations like pilings, barges, poles, cement blocks etc. and pearl oyster cages also.
Mandapam	9°16'N-79°8'E	Small embedded rocks	Concrete pillars and cement blocks of Jetty
Pamban	09°16′52.1″N 79°11′53.5″E	Corals and molluscan shells, embedded rocks	Nil

Table 2: Number of Ascidians Encountered During the Study Period at Different Stations

Species	S/C	Stations												
		MP	PB	TN	TR	KP	KLP	UV	CM	PK	MT	KPM	CL	VZM
Sub Order: Aplousobranchia														
Family: Polycitoridae														
*Eudistomapyriforme*Herdman	C	X	-	-	X	-	-	-	-	-	-	-	-	-
E.laysani(Sluiter,1990)	C	X	-	-	-	-	-	-	-	-	-	-	-	-
*E.viridi*Tokioka (1985)	C	-	-	X	-	-	-	-	-	-	-	-	-	-
*E.muscosum*Kott,1990		-	-	X	-	-	-	-	-	-	-	-	-	-
*E.microlarvum*Kott,1990		-	-	-	X	-	-	-	-	-	-	-	-	-
**E.sluiteri*Hartmeyer, 1909		-	-	-	X	-	-	-	-	-	-	-	-	-
*Synoicumindicum*Meenakshi,2003		-	-	-	X	-	-	-	-	-	-	-	-	-
Family: Polyclinoidae														
*Aplidiummultiplicatum*Sluiter,1909		-	-	-	-	-	-	-	-	-	-	-	-	X
Aplidiopsis sp., Lahille,1890		-	-	-	X	-	-	-	-	-	-	-	-	-
Polyclinum nudum Kott,1992		-	-	-	-	-	-	-	-	-	-	-	-	X
*P.saturnium*Savigny,1816		-	-	-	-	-	-	-	-	-	-	-	-	X
*P.fungosum*Herdman,1886		-	-	-	-	-	-	-	-	-	-	-	-	X
*P.indicum*Sebestian,1954		X	-	X	-	-	-	-	-	-	-	-	-	-
*P.madrasensis*Sebestian,1952		X	-	X	-	-	-	-	-	-	-	-	-	-
Family: Didemnidae														
Tridemnumsavigny(Herdman,1886)		-	-	-	-	-	-	-	-	-	-	-	-	X
Tridemnum sp.,		X	-	-	-	-	-	-	-	-	-	-	-	-
*Didemnum moselayi*Herdman,1866		-	-	X	-	-	-	-	-	-	-	-	-	-
*D.psammathodes*Sluiter,1895		X	X	X	X	X	X	X	-	-	X	-	-	X
*D.nekozita*Tokioka,1967		-	-	X	-	-	-	-	-	-	-	-	-	-
*D.candidum*Savingny,1816		-	-	-	-	-	-	-	-	-	X	-	-	X
**D.similiguwa*Oka, Suetsegu& Hirose, 2005		-	-	-	-	-	-	-	-	-	-	-	X	-
Diplosoma macdonaldi Herdman,1886		X	-	-	-	-	-	-	-	-	-	-	-	-
Lissoclinum fragile Van Name,1902		-	X	X	-	-	-	X	X	-	-	-	-	X
L.bistratum(Sluiter,1905)		-	-	X	-	-	-	-	-	-	-	-	-	-

Sub Order: Phlebobranchia														
Family: Perophoridae														
Ecteinascidia garstangi Sluiter,1909	C	-	-	-	-	-	-	-	X	-	-	-	-	-
*E.venui*Meenakshi,1997	C	X	-	-	-	-	-	-	-	-	-	-	-	-
Perophora formosana Oka,1931	C	X	X	X	-	-	-	-	X	-	-	-	-	-
Family : Asciidae														
Phallusia nigra Savigny,1816		-	-	-	-	-	-	-	-	-	-	-	-	X
Sub Order: Stolidobranchia														
Family: Styelidae														
*Botrylloides schlosseri (*Pallas,1766*)*		-	-	-	-	-	-	-	X	-	-	-	X	-
*B.magnicoecum(*Hartmeyer,1912*)*		-	-	-	-	-	-	-	-	-	-	-	X	-
*B.leachie(*Saivigny, 1816*)*		-	-	-	-	-	-	-	-	-	-	-	X	-
B.chevelence		-	-	-	-	-	-	-	-	-	-	-	X	-
Symplegma oceania Tokioka,1961		X	X	-	-	-	-	-	-	-	-	-	-	-
*Polycarpa*sp.,		-	-	-	-	-	-	-	-	-	-	-	X	-
Cnemedocarpa Sp., Huntsman,1912		-	-	-	-	-	-	-	-	-	-	-	X	-
Family: Pyuridae														
*Herdmania pallida*Savigny,1816		-	-	-	-	X	X	-	-	-	-	-	-	X
Total		10	4	10	6	2	2	2	4	0	2	0	7	10

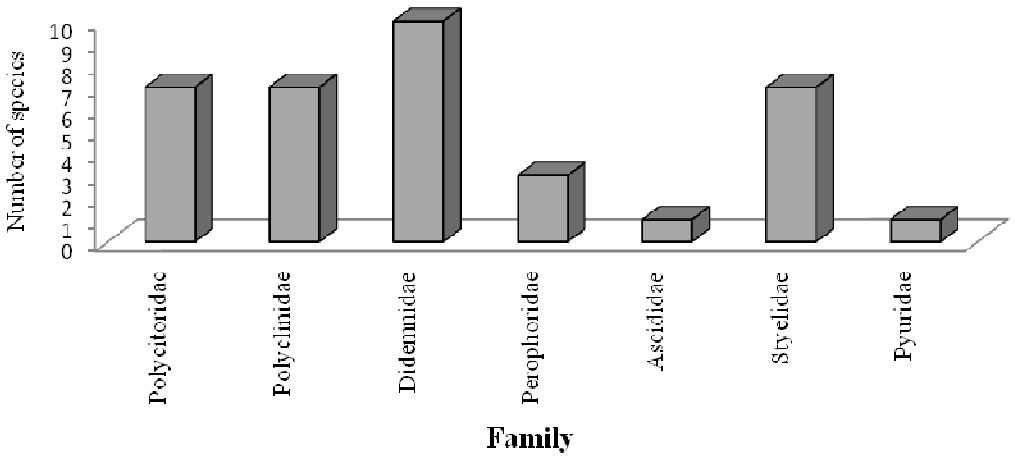

Figure 1: Number of Ascidian Species Belonging to Different Family

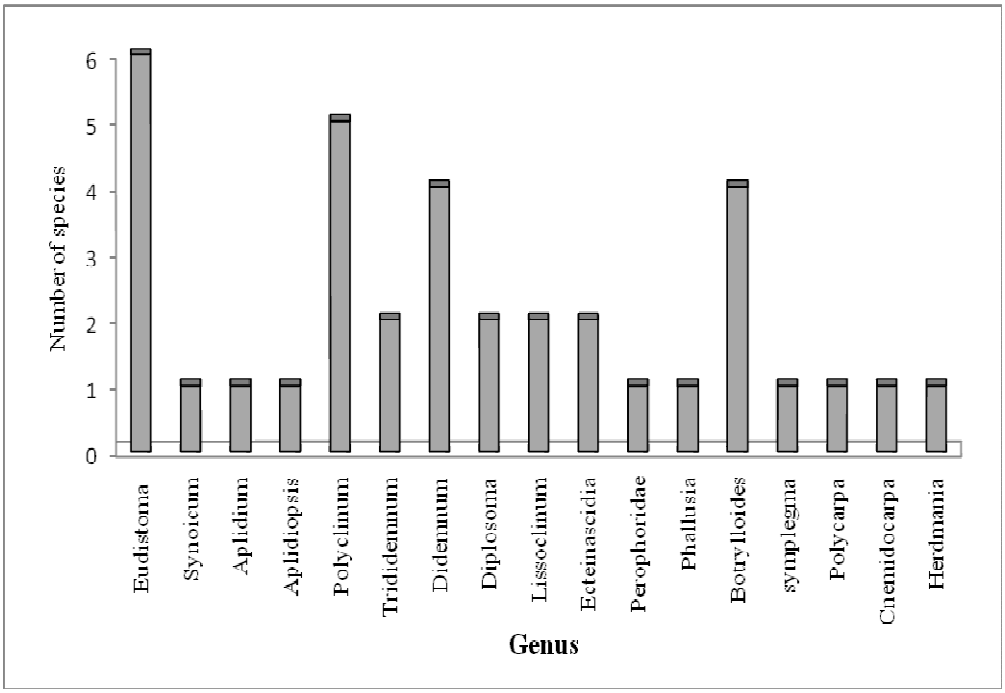

Figure 2: Number of *Ascidian* Species Belonging to Various Genera